# Challenges and Opportunities in Renewable Energy and Chemicals

34th Governor's Conference on the Environment

Aiguo Liu, Ph.D.
Sud-Chemie Inc. 1600 W. Hill, Louisville, KY

October 21, 2010

SÜD-CHEMIE
CREATING PERFORMANCE TECHNOLOGY

# Outline

- Overview of Süd-Chemie
  - Background/history
  - Global presence
  - Business focuses
- Strategic R&D and Investment in Renewable Energy and Fuels by Süd-Chemie
  - Bioethanol
  - Battery technology
  - Liquid fuels from coal or biomass
  - Chemicals from renewable resources

# Süd-Chemie: developing future-oriented products for more than 150 years

1857 1890 1930 1970 2010

1857: Founding of BAG (now Süd-Chemie AG) in Heufeld; founding shareholder: Justus von Liebig

Fertiliser

1906: Bleaching earth and bentonite products

Bleaching earth/bentonite

1962: Start of catalyst business

Catalysts

1970: Production of foundry chemicals based on bentonite

Foundry chemicals

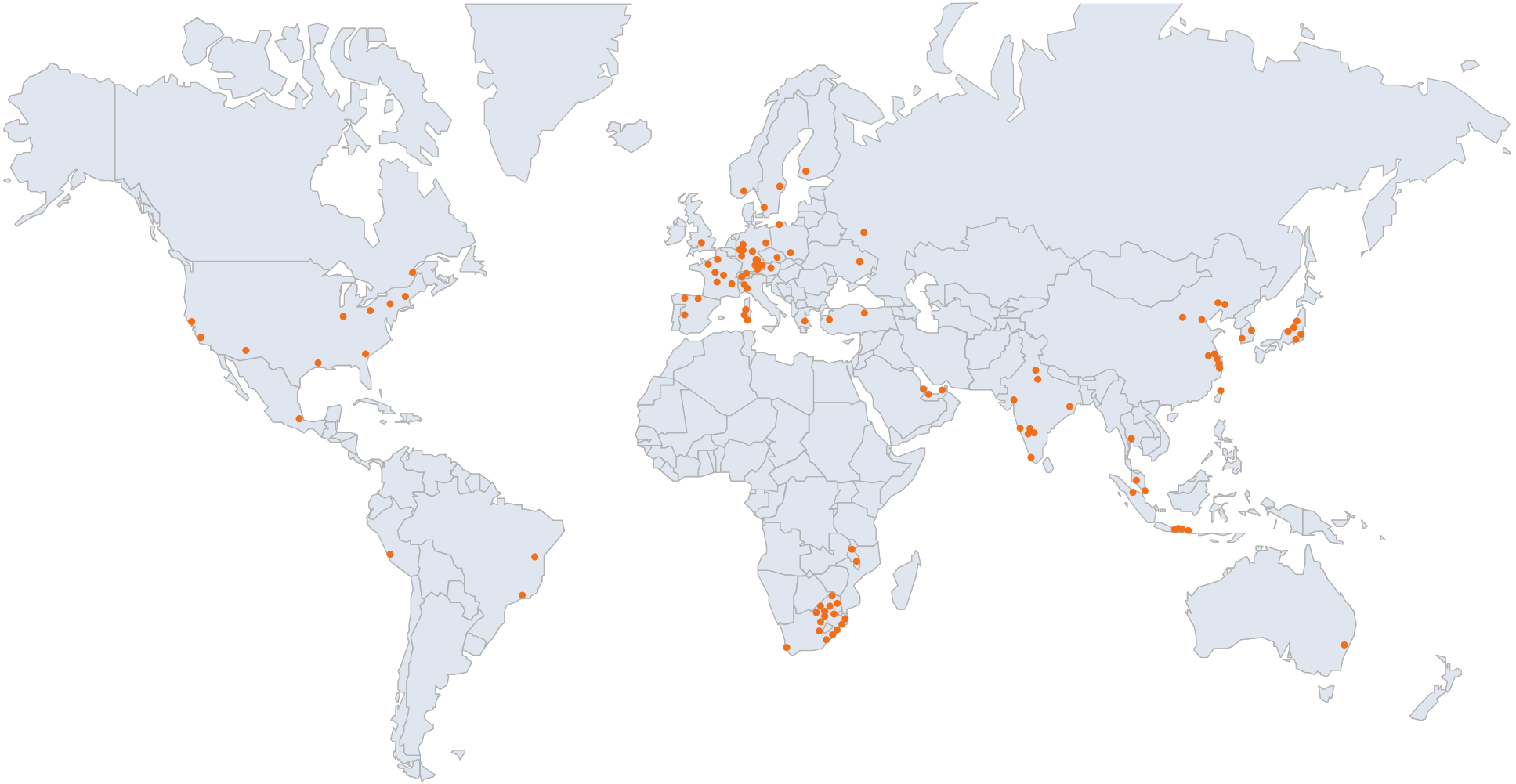
1996: Entry into pharmaceutical protection packaging and water treatment business

Manufacturer of Cleantech products:

- Biocatalysts
- Exhaust gas purification catalysts

- Lithium ion battery materials
- CTL/GTL catalysts

# Proximity to customers with around 80 production and sales centres in around 40 countries worldwide



# 29 R&D sites safeguard our technological leadership

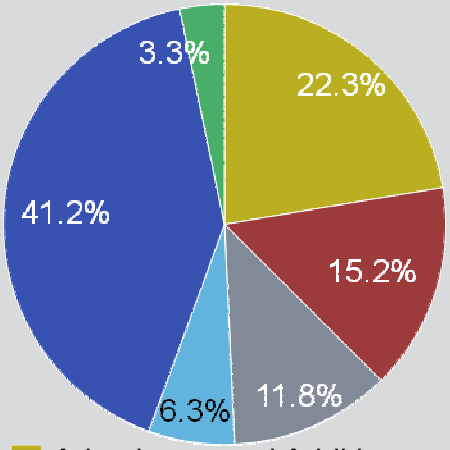
# Highly innovative global technology company

## Süd-Chemie Group

- Products enable efficient use of resources in customers' value-added chains
- Core business: adsorbents, additives and catalysts
- World market leader in niche markets
- Leading innovator in future areas
- Business expansion, mainly in growth markets worldwide
- SÜD-CHEMIE GROUP Sales: 1,071.6 (Fiscal 2009, EUR million); Employees: 6,485

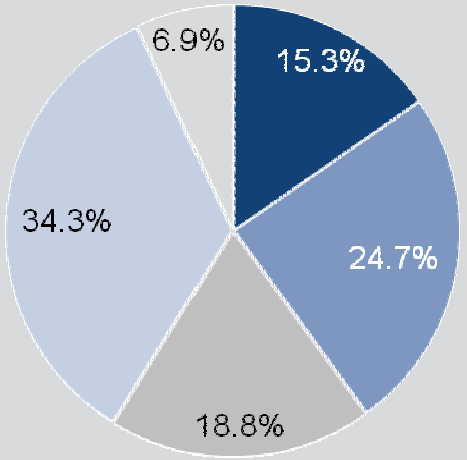
## Business Units

(Sales 2009: EUR 1,071.6 million)




## Regional focus

(sales by region 2009)




## Strategic focus

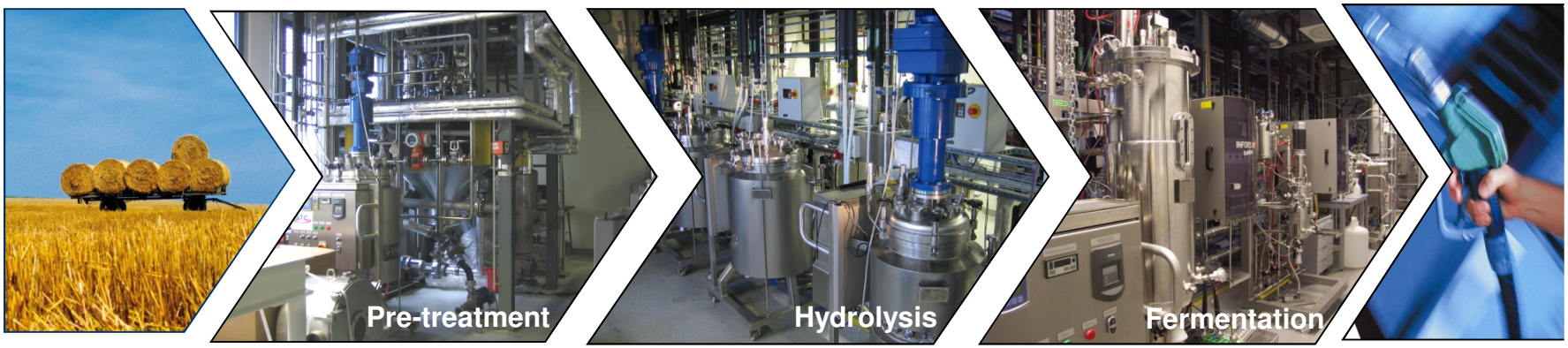
- Technology and innovation
- Customer loyalty and orientation
- Process optimisation
- Portfolio and investment management

# Enzymes (biocatalysts) for Bioethanol production

- Dedicated research center in Munich for enzyme and biomass process
- Integrated process with dedicated enzyme production
- Raw material and product-specific enzyme development
- Construction of demonstration production of bioethanol from lignocellulosic raw material
- Collaborate with and partially financed by Bavaria Government of Germany

sunliquid®#

**The sunliquid® process developed by Süd-Chemie to produce cellulose ethanol**




#sunliquid® is a registered trademark of Süd-Chemie AG

# Catalyst solutions as efficient alternatives to crude oil

Süd-Chemie catalysts enable chemical products to be made using the fossil fuels natural gas, coal and biomass, as an alternative to crude oil

**Gas-to-liquid (GTL)/Gas-to-chemicals (GTC)**

Only catalyst producer in natural-gas-rich country of Qatar

Manufacturing processes of chemicals and fuels from natural gas

**Coal-to-liquid (CTL)/Coal-to-chemicals (CTC)**

- Coal-to-methanol, e.g. MEGAMAX®* catalysts)
- Coal-to-propylene (MTPROP®* catalysts for the Lurgi MTP®# process)
- Synthetic gas catalysts: R&D partnership with Dow Chemicals for manufacturing chemicals from coal/biomass

* MEGAMAX® and MTPROP®* **are registered trademarks of Süd-Chemie AG**

# MTP® is a registered German trademark of Lurgi GmbH

# High-growth future markets

**Leading catalyst producer for hydrogen production for refineries and fuel cells**

- R&D projects with leading fuel cell system suppliers
- *Stationary* fuel cell systems: growing demand for applications in hotels, hospitals, public authorities, private households
- *Mobile* fuel cell systems for cars with hydrogen drives

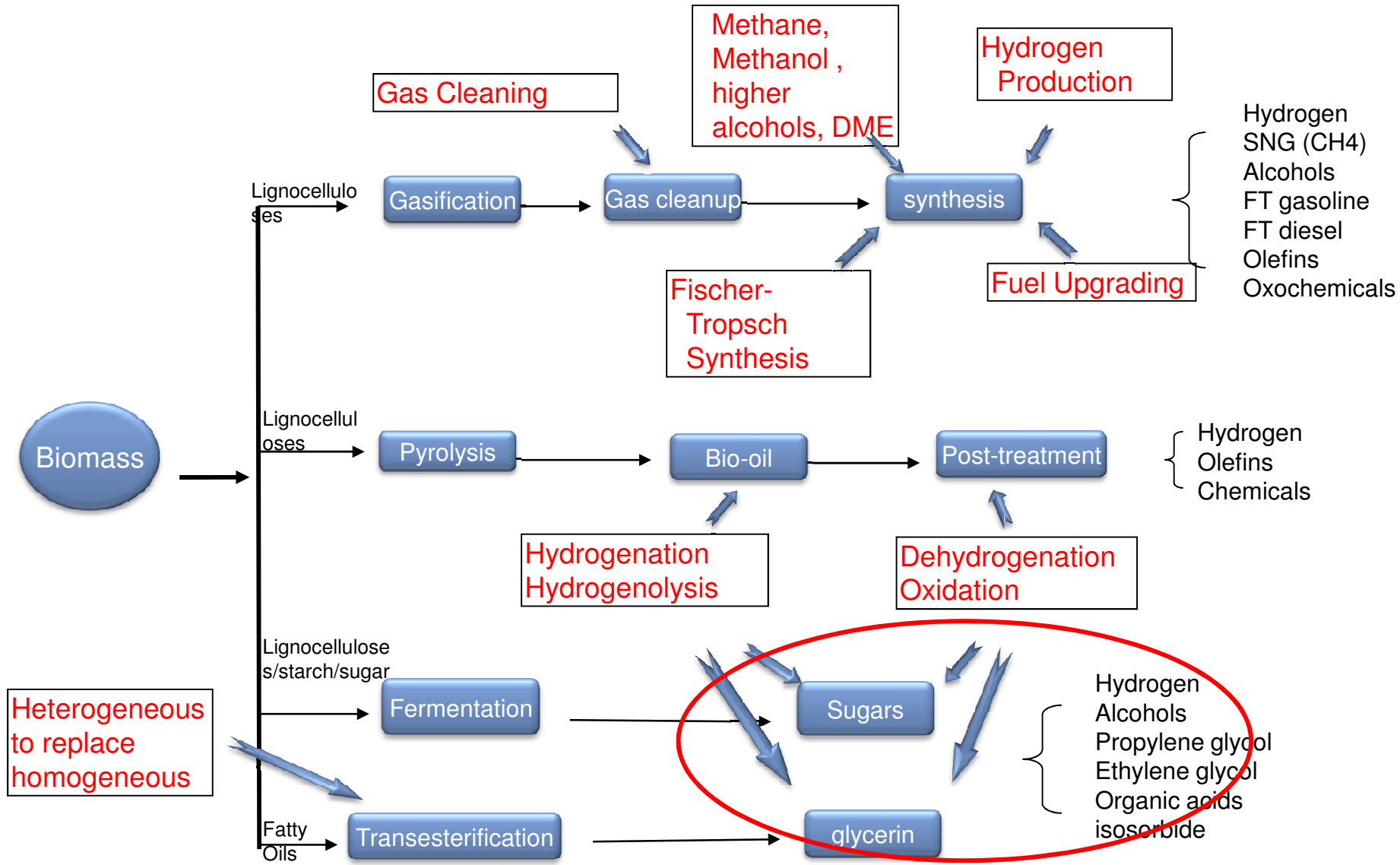
**Süd-Chemie develops innovative battery materials**

- Lithium iron phosphate is the latest generation of cathode material in electric drives (high performance, safe, patent protected)
- Production in Canada and Germany
- Cooperation with leading battery and vehicle manufacturers and suppliers

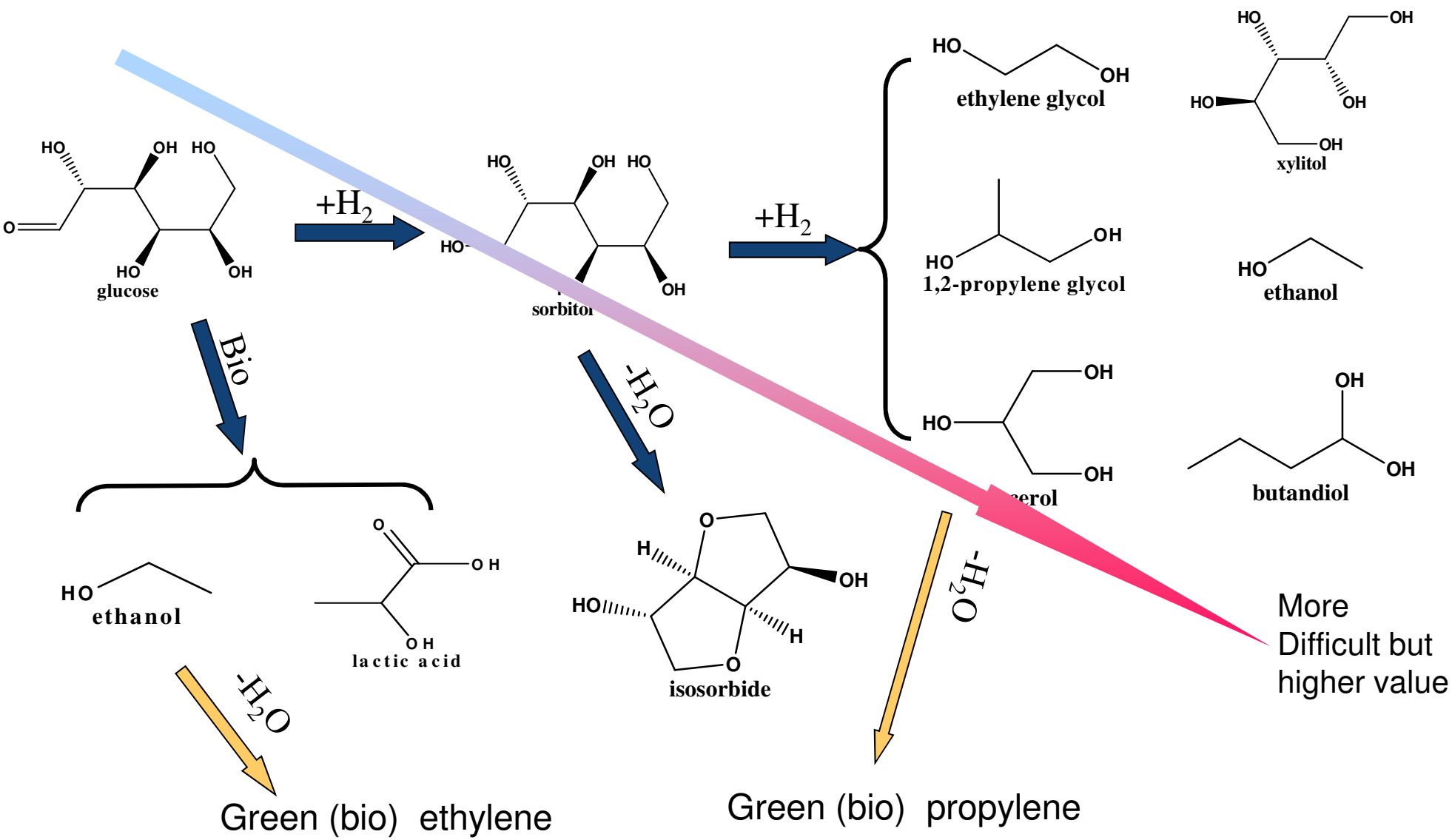
**Diesel emissions catalysts for the automotive industry:**

- Launch of production of diesel emissions catalysts for heavy-duty lorries at Heufeld

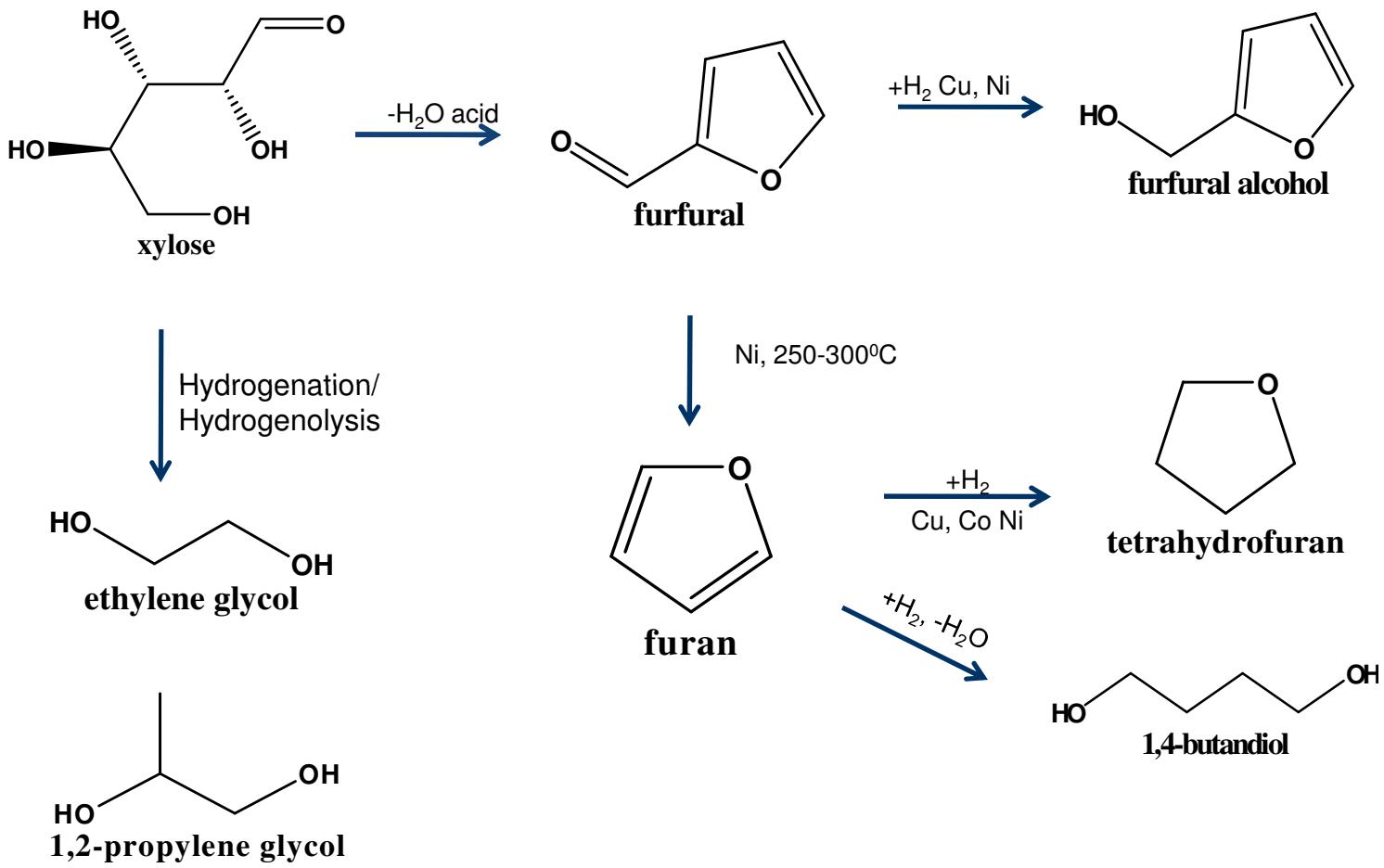
# Holistic Approach towards biomass conversion



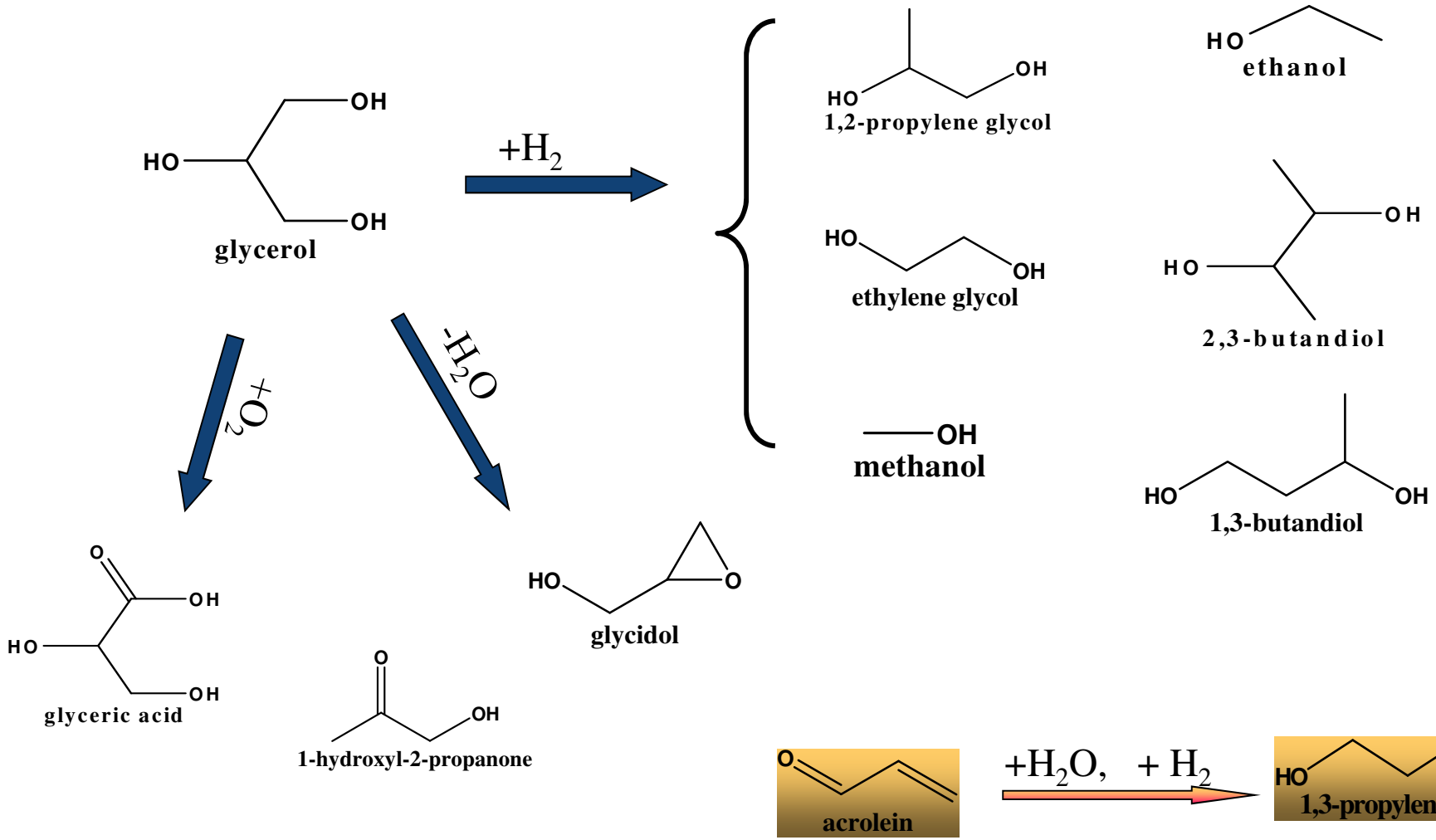
# C6 Sugar Platform



# C5 Sugar Platform



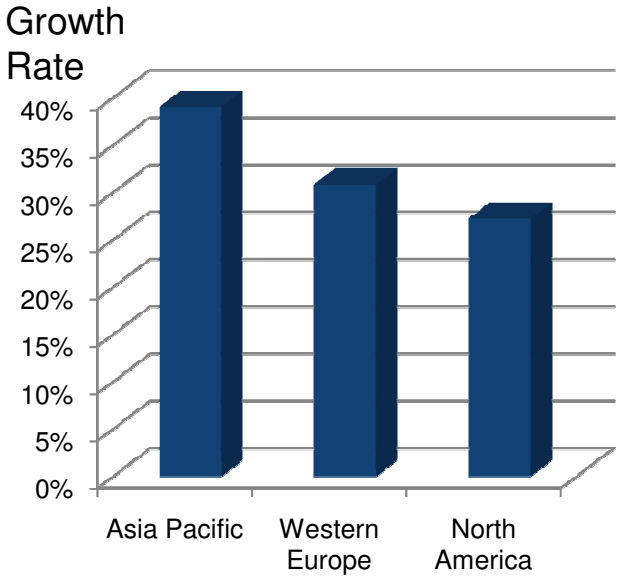
# Glycerol Platform



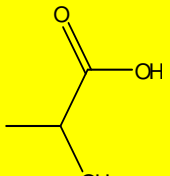
# Polymer building blocks from Biomass - Biopolymers

Estimated annual growth of ~20%

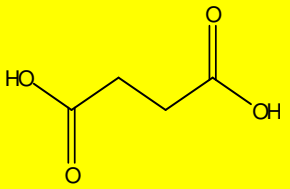
Could reach >2.6 million tons by 2015




Commercial



lactic acid



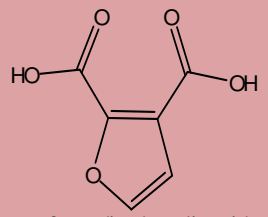
succinic acid

isosorbide

Developmental

adipic acid

Futuristic



furan dicarboxylic acid

## Summary

- Tremendous opportunities and returns
- Many technical challenges
- Combined production of bioenergy and biochemicals
- Right catalysts make process feasible
- Concerted efforts - commercial entities/private sectors working together with local community and governments